JACC: CARDIOVASCULAR INTERVENTIONS VOL. 4, NO. 9, 2011

ISSN 1936-8798/$36.00

PUBLISHED BY ELSEVIER INC.

DOI: 10.1016/j.jcin.2011.05.020

IMAGES IN INTERVENTION

Optical Frequency Domain Imaging of Stent Fracture and Coronary Dissection Associated With Intraplaque Hemorrhage

Masataka Nakano, MD, Marc Vorpahl, MD, Fumiyuki Otsuka, MD, Renu Virmani, MD

Gaithersburg, Maryland

A 64-year-old female with history of hypertension, end-stage renal disease on intermittent dialysis, and percutaneous coronary intervention with bare-metal stent 8 years ago presented to the emergency room following leg injury and development of a hematoma. Physical and imaging studies showed no evidence of bone fracture, so she was discharged with cessation of antiplatelet therapy. Four days later, she again presented to the emergency room with nausea and vomiting; despite intensive resuscitation, the patient died. Autopsy revealed acute myocardial infarction of the anterolateral wall of left ventricle, and the stented segment of the proximal left anterior descending artery was interrogated by optical frequency domain imaging (OFDI) and followed by histological assessment. OFDI demonstrated presence of stent fracture and disruption of the neointima extending into the area behind the stent (Fig. 1). Histology confirmed the presence of coronary dissection and thrombus formation in the cavity, which was thought to lead to micro emboli in the downstream intramural arteries. Furthermore, the comparison proved the presence of hemorrhage and fibrin accumulation around struts in histology with a relatively dark appearance in OFDI.

Late stent thrombosis (LST) is a rare phenomenon that is associated with a high mortality rate. Although the etiology of LST is considered multifactorial, clinical and histological studies elucidated delayed healing, excessive inflammation with/without a hypersensitivity reaction, or neoatherosclerotic change within neointima are predictors of LST in drug-eluting and bare-metal stents (1–4). Other minor causes include stent fracture with neointimal dissection. OFDI has shown a good ability to recognize structural details of vessel wall in the stented coronary artery and may be useful in stratifying the risk of LST in the patients with stent implantation.

Reprint requests and correspondence: Dr. Renu Virmani, CVPath Institute, Inc., 19 Firstfield Road, Gaithersburg, Maryland 20878. E-mail: rvirmani@cvpath.org.

From CVPath Institute, Gaithersburg, Maryland. Terumo Corporation, Tokyo, Japan, supported this study. Dr. Virmani is a consultant for Terumo Corporation, Abbott Vascular, Arsenal Medical, Atrium Medical Corp., Biosensors International, GlaxoSmithKline, Lutonix, Medtronic AVE, and W.L. Gore. All other authors have reported that they have no relationships relevant with the contents of this paper to disclose.

Manuscript received March 22, 2011; revised manuscript received April 15, 2011, accepted May 3, 2011.

REFERENCES

1. Lee CW, Kang SJ, Park DW, et al. Intravascular ultrasound findings in patients with very late stent thrombosis after either drug-eluting or bare-metal stent implantation. J Am Coll Cardiol 2010;55:1936–42.
2. Finn AV, Joner M, Nakazawa G, et al. Pathological correlates of late drug-eluting stent thrombosis: strut coverage as a marker of endothelialization. Circulation 2007;115:2435–41.
3. Nakazawa G, Finn AV, Vorpahl M, Ladich ER, Kolodgie FD, Virmani R. Coronary responses and differential mechanisms of late stent thrombosis attributed to first-generation sirolimus- and paclitaxel-eluting stents. J Am Coll Cardiol 2011;57:390–8.
4. Nakazawa G, Otsuka F, Nakano M, et al. The pathology of neoatherosclerosis in human coronary implants bare-metal and drug-eluting stents. J Am Coll Cardiol 2011;57:1314–22.

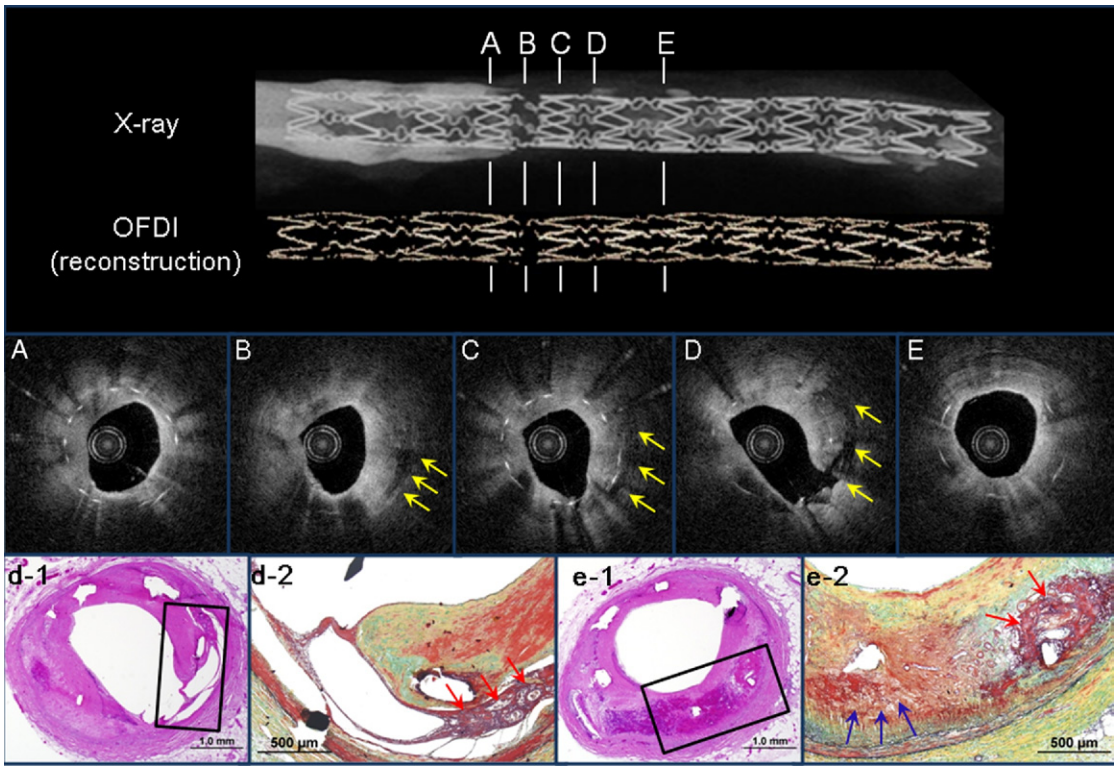

Figure 1. X-Ray, OFDI, and Corresponding Histological Images of Stented Coronary Segments Showing Stent Fracture Associated With Dissection

Post-mortem X-ray and reconstructed optical frequency domain imaging (OFDI) images **(top panel)** demonstrate a remarkable similarity with complete stent fracture being clearly identified at the edge of severe calcification. Cross-sectional OFDI images corresponding to **A to E** on X-ray illustrate the fracture site as absence of stent strut **(B).** Further, dissection is identified as **black area (yellow arrows)** in **B, C, and D**. **(d-1)** Histological section corresponding to **D,** which confirmed the presence of neointimal dissection burrowing deep into plaque behind the stent. Magnified image **(d-2)** reveals presence of thrombus in the cavity **(red arrows). (e-1)** Histology corresponding to OFDI image in **E** demonstrates hemorrhage **(blue arrows)** and fibrin accumulation **(red arrows)** around struts **(e-2),** which are likely the result of stent fracture and dissection.